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POWER COST STUDY:

MISSOURI 71 MONITEAU //

2 (U.S. RURAL ELECTRIFICATION ADMINISTRATION, *Power Division*)
WASHINGTON 25, D. C.

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MISSOURI 71 MONITEAUSYSTEM POWER ANALYSIS

The Central Electric Power Cooperative (Missouri 71 Moniteau) received an initial loan in the amount of \$11,350,000 on November 21, 1949 to construct a steam generating plant and a transmission system to serve the power requirements of its member cooperatives in conjunction with contractual arrangements with the Southwestern Power Administration.

Since the loan was made, the cooperative through detailed engineering studies has determined that because of increased labor and material costs on the original proposed project, the necessity of relocating the generating plant site and resulting rerouting of certain transmission lines, and an increase in transmission facilities needed to provide adequate service to the member cooperatives, a deficiency loan of \$2,538,000 is needed to complete the project. Concurrence in these changes has been received from SPA.

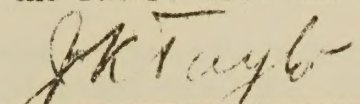
Under terms of contractual arrangements including all necessary amendments between SPA and Central, the estimated cost of power to members of Central while serving an anticipated allocated load of 259,592,244 kwh is 6.0 mills per kwh delivered.

If, for any reason, Central is obligated to operate, maintain and pay all costs in connection with the generating plant and transmission system it proposes to construct, and to purchase the balance of its power requirements from SPA at Schedule A rates, the estimated cost of power while serving the anticipated allocated load is 10.0 mills per kwh delivered.

In order to solve a serious power supply situation requiring immediate attention on two of the member cooperatives, Missouri 19 Boone and Missouri 24 Callaway, until Central's system is able to supply the power, Central has entered into an agreement with the Northeast Missouri Electric Power Cooperative (Missouri 70 Shelby) for an interim supply of power through an interconnection at Perry, Missouri. It is expected that Central's transmission system and generating plant will be in operation sometime in the latter part of 1952.

The over-all power supply situation remains critical in the area. No substantial improvement has taken place since the original loan was made nor is any expected in this regard until Central's facilities are in operation under the contractual arrangements as agreed upon between Central and SPA covering the additional investments and facilities considered herein the member cooperatives will realize a substantial savings in the cost of power. Under a condition wherein Central was forced to operate the system, the member cooperatives would not only be able to operate on a sound economic basis but under conditions of more adequate and reliable service as well.

Stand-by arrangements will continue in the future with the Missouri 70 Shelby source.


J. K. Taylor, Head
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MISSOURI 71 MONITEAU

POWER COST STUDY

INTRODUCTION

This study considers the effect of a deficiency loan in the amount of \$2,538,000 to provide for the increased requirements of the Central Electric Power Cooperative.

Consideration is given to the present existing contractual arrangements including anticipated amendments between Central and SPA and also determines the cost of power assuming Central would be required to operate its own system. All cost of power calculations have been determined for the allocated loads only.

CONCLUSIONS

A loan in the amount of \$2,538,000 is required to provide for a deficiency in funds to complete the steam generating plant and transmission system as originally proposed and to provide certain additional transmission facilities. The loan will cover the following:

Deficiency on Generating Plant (1-15,000 kw unit)	\$680,000
Deficiency and additional facilities on transmission system	1,819,000
Deficiency for General Plant and other purposes	39,000
Total	<u>\$2,538,000</u>

Details of the facilities required are shown in Appendix II.

The estimated cost of power while serving the anticipated allocated loads of 259,592,244 kwh delivered to the step-down substations is estimated to be 6.0 mills per kwh. If Central is required to operate its own system, to pay all expenses in connection therewith and to purchase balance of its power requirements from SPA at SPA's Schedule A rates, the estimated cost of power while serving the allocated loads is 10.0 mills per kwh delivered.

LOAD DATA

Load data used in this study were received from the A & L Division as outlined in its memorandum dated July 13, 1951. Details of the loads are given in Appendix I.

PRESENT FACILITIES AND WHOLESALE POWER SITUATION

Central has received an initial loan and is now in the process of construction. Under the present anticipated construction schedule, construction of the entire system is expected to be completed sometime in 1952.

During the interim period the member cooperatives are either purchasing from their original suppliers or have obtained other sources. The present situation as to power for each of the member cooperatives is as follows:

Missouri 19 Boone - The cooperative presently purchases a majority of its requirements from the City of Columbia at a cost of 1.42 cents per kwh. The cooperative purchases the balance of its requirements from the Missouri Power and Light Company at two points of delivery at a cost approximating 2 cents per kwh. The City has informed the cooperative that it is unable to continue to supply the power requirements of the cooperative.

Missouri 22 Howard - Until December 1950, the cooperative purchased its power from the City of Fayette. An explosion in the City's plant necessitated discontinuance of service by the City. The cooperative was able to obtain power from the Missouri Power and Light Company as a substitution for the source from the City but it should be noted that the Company had on numerous occasions prior to the explosion refused to make service available. The Company now makes service available at one point of delivery but another point is required.

The average cost of power from the City of Fayette during calendar year 1950 was 1.29 cents per kwh. Since purchasing power from Missouri Power and Light, the average has been .94 cents per kwh.

Central has construction underway in Missouri 22's area to serve the substation at Fayette and a proposed substation at Yates. A portion of the Fayette load is now encumbered under the Missouri Power and Light contract. In addition another portion of Missouri 22's load, which will in the future be served out of the Yates substation when it is constructed, is also being served out of the Fayette substation. It is intended that as soon as Central's facilities are available, that portion of the Yates load now being served out of Fayette will be served by Central. This has been agreed upon among Missouri 22, Central and Missouri Power and Light. This intent has been also outlined in a letter dated January 13, 1951 from Central to Missouri 22, a copy of which was sent to the power company.

Missouri 24 Callaway - The cooperative presently purchases power from the City of Fulton at a rate of 1.52 cents per kwh. The cooperative's load is taxing the City's facilities as the City does not have firm capacity to meet load requirements. Failure of any part of the City's plant would result in an outage to the cooperative.

Missouri 36 Audrain - This cooperative is supplied power by the Missouri Power and Light Company at a cost of approximately 9.7 mills per kwh. Additional points of delivery are required to meet the power requirements of the cooperative in the future.

Missouri 45 Osage - This cooperative purchases its power at two points of delivery from the Missouri Power and Light Company -- at one point at the cost of 1.38 cents per kwh and at the other 9.8 mills per kwh. At the higher cost point of delivery, power was formerly supplied by the Gasconade Power Company which has since been acquired by the Missouri Power and Light Company. Before the transfer of the properties were effected Gasconade informed the cooperative that it would be glad to be relieve of the responsibility for serving the load. The former company refused to make an additional point of delivery available to the cooperative to relieve an overloaded point of delivery.

Missouri 59 Cole - Sho-Me presently obtains power from the Union Electric Company, Empire District Electric Company, its own small hydro plant and SPA at West Plains. The combined average cost of power delivered to Sho-Me's 69 kv transmission system is approximately 1 cent per kwh. In order for Union Electric to continue to supply additional requirements, it would have to install an additional high voltage transmission substation for the northern end of Sho-Me's system. Empire and SPA are delivering as much power as their power facilities can deliver to the southern end of Sho-Me's system. Under existing conditions none of the existing sources are constructing additional facilities to make larger deliveries to Sho-Me.

Arrangements with Northeast Missouri Electric Power Cooperative

An agreement dated October 23, 1950 has been entered in between Northeast and Central providing for an interconnection with Northeast's system at Perry, Missouri for an interim supply of power on a surplus basis. It is proposed under this contract that Central construct a 69 kv tie to this point from its system. Service to Missouri 19, Missouri 22 and Missouri 24 is contemplated as soon as this tie and the portion of Central's system needed to serve these cooperatives are completed to relieve a critical situation existing in the area. Completion of such facilities is expected in the latter part of 1951 which is prior to the time service from Central will be available. This agreement between Central and Northeast became effective on February 5, 1951 and is to continue until July 1, 1952 and thereafter until terminated by either party's giving to the other not less than 3 months written notice of its desire to terminate.

Under this agreement Northeast is to operate and maintain the transmission facilities which Central is to construct. Central is to reimburse Northeast for the actual costs with an understanding that the administration and general expenses shall not exceed 10 percent of the maintenance cost.

Although under terms of the agreement Northeast will make available to Central only that power and energy it has in excess of its own requirements, for the interim period it is expected that Northeast will be able to supply that portion of Central's needs on a firm basis since Northeast has contracted for additional power with the Bureau of Mines. Power supplied at Perry will come largely from the Bureau of Mines source.

SPA Arrangements

To cover the various changes in system configuration caused by the relocation of the steam plant and an increase in the number of delivery points, SPA and Central have entered into agreements dated March 20, 1951 to amend the lease option contract and the power contract both dated January 9, 1950. These amendments have yet to be approved by REA. Because of the deficiency loan, it is necessary that the agreements between SPA and Central be further amended. In a letter dated July 31, 1951 from SPA to Central, SPA has agreed to amend the existing contracts to include the increased investments and changes required by Central's deficiency request. It is assumed that the other terms of the existing contracts will not be changed.

Details of the original contracts between SPA and Central are outlined in the October 3, 1949 power cost study.

PROPOSED FACILITIES

The proposed loan is to enable the cooperative to complete construction of the system as outlined in the original power cost study dated October 3, 1949 and to provide for certain additional transmission facilities. A comparison of the facilities previously provided and now required are shown in the following:

<u>Previous Loan</u>	<u>New Loan</u>	<u>Change</u>
Generation		
1 - 15,000 kw steam unit	Same	None
Transmission		
2 - 30,000/40,000 kva 161/69 kv substations	Same	None
13(20,750 kva) 69/12.5 kv subs.	20 (23,500 kva)	7 subs. (2750 kva)
182 miles 161 kv transmission line	183.1 miles	1.1 miles
283 miles 69 kv transmission line	335.3 miles	55.3 miles
Misc. switching, communication, relaying	Same	None
Power Factor Corrective Equipment	Same	None
No River Crossings	2-69 kv River Crossings	2-69 kv Crossings
General Plant		Increase in funds

The steam plant location has been changed from near Jefferson City, Missouri as proposed in the previous study to a site near Chamois, Missouri. This change was necessitated by later engineering studies which indicated that a more satisfactory site existed near Chamois, Missouri. The construction of the plant is now underway. In addition to the relocation of the plant certain rerouting of lines became necessary caused not only by the relocation of the plant but also because system studies undertaken by the member cooperatives after the loan was made indicated that additional substations were needed. Construction work on the transmission system is also underway. The entire project including the 161 kv tie with SPA is scheduled for completion sometime in 1952.

A tie-in with the Northeast Missouri Electric Power Cooperative (Missouri 70 Shelby) through Northeast's Perry substation has been agreed upon. Central is to build from this substation to interconnect its own system. This tie along with other necessary transmission lines in the northern section of Central's service area are to be constructed first since these facilities are needed as soon as possible to relieve a critical power shortage situation existing on Missouri 19 and Missouri 24. Power is now available from Missouri 70 at the Perry substation.

COST OF POWER

The estimated cost of power under present SPA contractual arrangements as amended or to be amended while serving an anticipated allocated load of 259,592,244 kwh at the step-down substations is .60 cents per kwh delivered. It is assumed that all additional facilities provided by this loan will not affect the general terms of the present SPA contracts with Central. If Central were required to operate and maintain the proposed system including both the generation plant and transmission facilities and paying all expenses in connection with the system but purchasing its excess needs from SPA under Schedule A rates, the estimated allocated cost of power is 1.00 cents per kwh.

It should be noted that because of the magnitude of the total allocated demand (59,260 kw) and the total contract demand existing under present arrangements with SPA (70,000 kw to Central and 7,000 kw to Sho-Me) Central will be penalized somewhat because of its low demand. As pointed out in the October 3, 1949 power cost study, however, the anticipated yearly loads are approximately equal to the contract demand so that if these future loads are achieved, Central will not be penalized because of a high contract demand. When considering a yearly cost of power, therefore, the cost of power would be approximately .58 cents as shown in the October 3, 1949 study.

Consideration has also been given to the contribution made by the Sho-Me Niangua hydro plant and the 7,000 kw SPA-Sho-Me contract for delivery of power at West Plains.

Details of the calculations are given in Appendix III.

FUTURE FACILITIES

It is anticipated that service will in the future be extended to three additional cooperatives in the area, Missouri 57, Missouri 40 and Missouri 47. It is probable that additional substation facilities will be needed to serve the ultimate loads of the present member cooperatives. Although it is proposed that Missouri 40 be served from the Clinton substation located on the 161 kv line now under construction by N. W. Electric Power Cooperative, Inc. (Missouri 72 Gentry) between Bull Shoals and Missouri City, this plan may be altered if SPA is unable to provide this substation.

MISSOURI 71 MONITEAU

APPENDIX I

LOAD DATA

<u>Cooperative</u>	<u>KWH</u>	<u>KW</u>
Missouri 19 Boone	11,702,850	2,680
Missouri 22 Howard	4,824,565	1,100
Missouri 24 Callaway	9,641,625	2,200
Missouri 36 Audrain	22,967,100	5,230
Missouri 45 Osage	12,044,850	2,750
Missouri 59 Cole	<u>198,411,254</u>	<u>45,300</u>
	259,592,244	59,260

APPENDIX II

INVESTMENTS

KW Demand @ SS	59,260
Non-Div. Demand	62,200
Div. Demand	59,000
Capacity Gen. (Mo. 59 Cole)	
Niangua Hydro	600
Purchased SPA (Contract Demand)	
Central - SPA	70,000*
Sho-Me - SPA	7,000

*Available by second year after power from Bull Shoals is available.
Bull Shoals expected to be in operation in 1953.

THIS REQUEST

Generation

	<u>Original Budget</u>	<u>Revised Estimate</u>	<u>Deficiency</u>
Land and Land Rights	\$ 10,000	\$ 14,000	\$ 4,000
Structures and Improvements	780,000	1,197,000	417,000
Boiler Plant Equipment	1,000,000	1,279,910	279,910
Turbo Generator Unit	800,000	620,570	(179,430)
Accessory Electrical Equipment	160,000	290,819	130,819
Engineering	170,000	280,570	110,570
Contingencies	<u>175,000</u>	<u>100,401</u>	<u>(74,599)</u>
Sub-Total	\$3,095,000	\$3,783,270	\$688,270

Plant Substation

Labor and Materials	\$555,000	\$546,300	\$ (8,700)
Engineering	32,700	32,700	-
Contingencies	<u>8,500</u>	<u>8,930</u>	<u>430</u>
Sub-Total	\$596,200	\$587,930	\$ (8,270)

APPENDIX II (Cont'd)

<u>Transmission</u>	<u>Original Budget</u>	<u>Revised Estimate</u>	<u>Deficiency</u>
Lines: 161 KV 183.1 miles			
Labor & Materials	\$2,548,000	\$2,056,000	\$(492,000)
R/W Procurement	91,000	137,000	46,000
R/W Clearing	127,400	384,000	256,600
Engineering	145,600	120,000	(25,600)
Contingencies	125,000	220,000	95,000
Sub-Total	\$3,037,000	\$2,917,000	\$(120,000)
Lines: 69 kv 335.3 miles			
Labor and Materials	\$1,433,100	\$1,761,000	\$ 337,900
Misc. Switching, Comm., Relay	450,000	-	(450,000)
Power Factor Corrective Equipment	200,000	-	(200,000)
River Crossing	100,000	179,800	79,800
R/W Procurement	85,200	153,000	67,800
R/W Clearing	156,200	406,000	249,800
Engineering	102,240	109,100	6,860
Contingencies	85,760	213,850	128,090
Sub-Total	\$2,602,500	\$2,822,750	\$ 220,250
Substations - 161/69 kv - 2-30,000/40,000 KVA			
Land and Land Rights	-	\$ 9,000	\$ 9,000
Labor and Materials	\$1,110,000	1,939,000	829,000
Engineering	65,500	96,000	30,500
Contingencies	16,900	96,000	79,100
Sub-total	\$1,192,400	\$2,140,000	\$ 947,600
Substations - 69/13.2 kv 20 (23,500 kva)			
Land and Land Rights	-	\$ 15,000	\$ 15,000
Labor and Materials	\$ 375,000	1,040,000	665,000
Engineering	11,000	45,000	34,000
Contingencies	14,000	56,000	42,000
Sub-Total	\$ 400,000	\$1,156,000	\$ 756,000
Line Crossing	\$ 50,000	-	\$ (50,000)
General Plant	\$ 16,000	\$ 55,000	\$ 39,000
Other Purposes			
Pre-Loan	\$ 26,000	\$ 26,000	-
Legal			
Generation	7,000	7,000	-
Transmission	29,000	23,250	(5,750)
Overhead			
Generation (Plant Sub.)	1,800	1,800	-
Transmission	87,100	158,000	70,900
Working Capital	210,000	210,000	-
Sub-Total	\$ 360,900	\$ 426,050	\$ 65,150

APPENDIX II (Cont'd)

	<u>Original Budget</u>	<u>Revised Estimate</u>	<u>Deficiency</u>
<u>Summary of Investments</u>			
Generation*	\$3,700,000	\$4,380,000	\$ 680,000
Transmission**	7,398,000	9,217,000	1,819,000
General Plant & Other Purposes	252,000	291,000	39,000
Total	\$11,350,000	\$13,888,000	\$2,538,000

*Includes step-up substation, legal and overhead listed under Other Purposes.

**Includes legal and overhead listed under Other Purposes.

DESCRIPTION OF FACILITIES

Generation

1-15,000 kw (nameplate) 850#/in.², 9000FTT ASME-AIEE preferred standard steam generating unit

Plant Substation

1-15,000 kva 13.8/69 kv

1-15,000 kva 161/69 kv

Transmission*

Lines (69 kv)

<u>Sec.</u>	<u>Location</u>	<u>Mileage</u>	<u>Wire Size</u>
1	Columbia-Fayette	22.0	4/0
	Fayette-Yates	12.5	4/0
	Columbia-Sturgeon	20.1	4/0
	Sub-Total	54.6	
2	Sturgeon-Tipton Sta.	13.2	4/0
	Tipton Sta.-Santa Fe	11.2	4/0
	Santa Fe-Perry	15.7	4/0
	Fulton-Auxvasse	11.5	4/0
	Auxvasse-Mexico	12.0	4/0
	Mexico-Santa Fe	14.0	4/0
	Sub-Total	77.6	
3	Chamois-Tebbetts Crossing	8.5	D.C. 4/0 & 266.8 MCM
	Tebbetts Crossing-Summit	11.2	266.8
	Summit-Ashland	12.3	266.8
	Ashland-Columbia	15.0	266.8
	Chamois-Portland Crossing	4.5	D.C. 4/0 & 266.8 MCM
	Portland Crossing-Fulton	16.0	266.8
	Sub-Total	67.5	

APPENDIX II (Cont'd)

<u>Sec.</u>	<u>Location</u>	<u>Mileage</u>	<u>Wire Size</u>
4	Portland Crossing-Big Springs	11.2	4/0
	Big Springs-Mont. City	14.0	4/0
	Mont. City-Vandalia	14.6	4/0
	Vandalia-Scotts Corner	16.5	4/0
	Sub-Total	56.3	
5	Chamois-Mt. Sterling	9.0	4/0
	Mt. Sterling-Drake	18.0	4/0
	Mt. Sterling-Linn	14.0	4/0
	Tebbetts Crossing-Brazito	26.1	4/0
	Brazito-Eugene	12.2	4/0
	Sub-Total	79.3	
	Total	335.3	
<u>161 KV</u>			
1	Bull Shcals-Mansfield	55.1	556.50 MCM
2	Mansfield-Maries (1st half)	39.5	556.50 MCM
	Mansfield-Maries (2nd half)	39.5	556.50 MCM
3	Maries-Chamois	49.0	556.50 MCM
	Total	183.1	
<u>Substations (69 KV)</u>		<u>KVA</u>	
1	Columbia	2500	
	Fayette	1000	
	Yates	1000	
	Sturgeon	1500	
	Tipton Station	1000	
	Santa Fe	1000	
	Fulton	1000	
	Auxvasse	1000	
	Mexico	1000	
	Sub-Total (9)	11,000	
2	Summit	1000	
	Ashland	1000	
	Big Springs	1000	
	Montgomery City	1000	
	Vandalia	1000	
	Scotts Corner	1000	
	Sub-Total (6)	6,000	
3	Linn	1000	
	Brazito	1500	
	Eugene	1000	
	Mt. Sterling	1500	
	Drake	1500	
	Sub-Total (5)	6,500	
	Total (20)	23,500	

APPENDIX II (Cont'd)

161 KV

<u>Sec.</u>	<u>Location</u>	<u>KVA</u>
1	Mansfield	30,000
	Maries	30,000
	Total (2)	60,000

*Corresponds to data given in report dated June 4, 1951 submitted by Frank Horton and Company re Generation and Transmission Plant Investments for Missouri 71 Moniteau.

APPENDIX III

ANNUAL COST

I Cost of Power Under SPA Lease-Purchase Arrangement

	<u>Allocated Loads</u>
MWH @ SS	259,592
MWH, Gen. Niangua Hydro (Sho-Me)	10,000
MWH, pur. SPA (West Plains-Sho-Me)	30,000
MWH, pur. SPA, Central	219,592
KW Demand @ SS	59,260
KW Peaking Capacity Niangua Hydro	600
KW pur. SPA (West Plains-Sho-Me)	7,000 (18 years remaining)
KW pur. SPA, Contract Demand, Central	70,000
Purchased Power (Affecting Central Purchases) 35 Year Average	
Demand Charge	
70,000 X 35 X \$6.60	\$16,180,000
Energy Charge	
219,592,000 X \$.004 X 18	\$15,800,000
249,592,000 X .004 X 17	16,970,000
Sub-Total	\$32,770,000
Total Purchased Power	\$48,950,000
MWH, 35 year total	
219,592 X 18	3,950,000
249,592 X 17	4,240,000
	8,190,000
¢/kwh @ ss, 35 year average	.60

APPENDIX III (Cont'd)

II Cost of Power Under Central's Operation of System and Purchase from SPA

	<u>Allocated Loads</u>
MWH @ SS (Sho-Me & Central)	259,592
MWH @ sources	288,000
MWH @ Niangua Hydro	10,000
MWH @ West Plains Purchase Point (SPA)	28,600
MWH @ Bull Shoals & steam plant	249,400
MWH net, Steam Plant	70,000
MWH from Bull Shoals (Exclusive of West Plains)	179,400
Peak Demand @ SS - Non. Div.	59,260
Peak Demand @ Source - Non. Div.	62,200
Peak Demand @ Source - Div.	59,000
Dependable Peaking - Niangua Hydro	600
Steam Plant - Net Capability	15,800
Purchase Demand	42,600
 Yearly Expenses	
<u>Generation</u>	
MWH, net	70,000
Fuel* (\$.00335/kwh net)	\$234,500
Payroll	100,000
Maintenance Materials	26,200
Other Operating Supplies & Expenses	7,775
Taxes & Insurance	45,000
Interest & Amortization	179,500
Miscellaneous	15,025
	<u>\$608,000</u>
¢/kwh, net generated	.87
 <u>Purchased Power</u>	
Demand (42,600 X \$6.60/kw/year)	\$282,000
Energy (179,400 X \$.004)	718,000
	<u>\$1,000,000</u>
¢/kwh purchased	.56

*Based on latest estimate of Kuljian Corporation. \$5.88/T, 11,400 BTU/#,
13,000 BTU/net KWH

Transmission

O & M & Replacement	
183.1 miles - 161 kv	\$34,000
335.3 miles - 69 kv	40,000
60,000 kva - 161 kv substations	50,000
23,500 kva - 69 kv substations	25,000
Power factor corrective and other equipment	10,000
Taxes & Insurance	92,000
Interest & Amortization (4.1% X \$9,217,000)	378,000
Miscellaneous	12,000
Sub-Total	<u>\$641,000</u>

APPENDIX III (Cont'd)

<u>General & Administrative</u>	
Interest & Amortization (4.1% X \$291,000)	\$11,950
Replacement	7,400
Administrative	50,000
Miscellaneous	<u>1,650</u>
	\$71,000

SUMMARY OF ANNUAL COST

Generation	\$608,000
Purchased Power	1,000,000
Transmission	641,000
General & Administrative	<u>71,000</u>
Total	\$2,320,000
MWH @ SS served by Central	232,000
¢/kwh @ ss	1.00

